TOWN OF
NANTUCKET
ENERGY OFFICE

MEMORANDUM

TO: Libby Gibson, Town Manager

FROM: Lauren Sinatra, Energy Coordinator; Energy Office

RE: Update of Nantucket Energy Office Activities: First Quarter of FY2016

DATE: October 14, 2015

This memorandum provides a brief summary update of the activities of the Energy Office through the first quarter of FY2016. The Energy Office will be prepared to discuss these items with the Board of Selectmen on October 21, 2015.

Announcements

- Electric rates will be rising in November (until April 2016) to 13.129¢/kWh; a 29% increase vs. current rates (9.257¢/kWh). Last year, the winter rate was 16.273¢/kWh (19% higher than this year).
- Competitive electricity supply options available at present:
  - Conedison (10.65¢/kWh for 14 months)
  - Constellation (10.49¢/kWh for 12 or 24 months; renewable option available)
  - Viridian: 5% below utility for 12-months
- CCA (Municipal Electric Aggregation) RFP will be issued by the Town in October

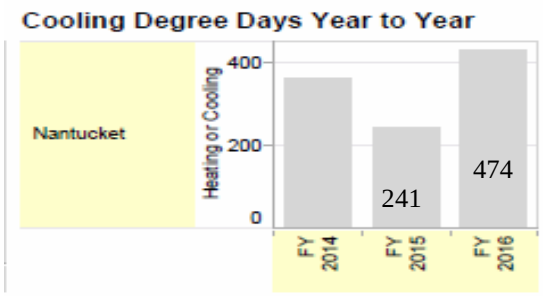
Municipal Facilities: Energy Efficiency and Conservation Efforts

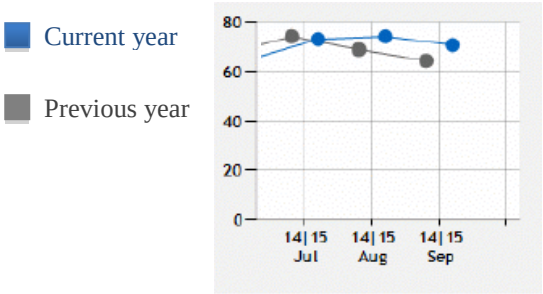
1. Monitoring of Town energy consumption. The following table compares energy consumption by municipal facilities and equipment during the first quarter (July-September) of fiscal years 2015 and 2016:

	Q1-FY2015	**Q1-FY2016**	**(=/-)%**
Electricity, kWh	3,157,229	3,338,041	**+5.4%**
Heating oil, gallons	3,805	1,460	-62%
Propane, gallons	5,069	2,100	-59%

Source: MassEnergy Insight data totals as of September 30, 2015, based upon National Grid data (automatically updated in software on a monthly basis), and quarterly delivery records supplied by Yates Gas and Harbor Fuel (input manually by Energy Coordinator).

Year	Total Energy Consumed (kWh)	Total Degree Days (Heating & Cooling)	kWh per degree day	Normalized kWh (based on 3-year average of Q1: 500.67)
Q1-FY2015	3,157,229	412	7663	**3,836,697**
Q1-FY2016	3,338,041	588 **(+29%)**	5677 (-26%)	**2,842,255 (-26%)**





Notable trends: There were above average temperatures in Nantucket during August and September of 2015. Electric usage increased 6% in Q1 of FY2016 vs. Q1 FY2015, however, there were significantly more "Cooling Degree Days" (49%) this year vs. last year. As a result, it would be assumed that certain municipal buildings had higher loads attributable to increased air-conditioning:

- 39% increase at Our Island Home; 75% increase at Saltmarsh Center
- 39% increase in Airport Terminal
- 17% increase at 37 Washington

- There was a 16% increase at Surfside Wastewater Treatment Plant, attributable to increased "dewatering" processes.
- There was a 14% reduction at the Sconset WWTP.
- 11% increase at Nantucket High School
- 2% increase at 16 Broad, which given the increased amount of cooling degree days, signals energy savings from the recently installed window AC unit programmable thermostats
- Lifeguard Dorm (Orkorwaw): **21% decrease**
- 4FG: **5% decrease**

2. <u>Energy assessments and energy efficiency upgrades at Municipal Facilities and Town-owned residences</u>

Municipal Facilities
Energy Office continues to encourage and offer support for the implementation of several energy saving (incentivized) measures and upgrades at:

- Planning and Land Use Services (2 Fairgrounds Road): Temperature Set-back controls
- Nantucket Public Schools: Hot water loop pump, heating & ventilation unit VFDs, demand control ventilation
- Surfside Wastewater Treatment Plant: Sludge Blower, Draft pumps, Aeration Blower, LEAP MBR
- Nantucket Memorial Airport: Recommissioning of Ground Source Heat Pump

The Energy Office has requested for the commercial account representative from National Grid to visit Nantucket during the week of November 2, 2015, to meet with each facility's operation team (and engineers where appropriate) to review the energy saving measures and opportunities.

Municipal Staff Housing
In November, the police dorms at the Loran Station property will receive a no-cost energy assessment. Once completed, all Town-owned residences will have participated in the Mass Save energy assessment program. Additionally, the Energy Office has helped Sherburne Commons to enroll all of their 24 cottages in the program, each benefitting from a wifi thermostat and heatpump water heater incentive.

3. Municipal Solar-PV Development

a. NREL Analysis

In late August, the Energy Office submitted a request to the National Renewable Energy Laboratory (NREL) seeking assistance to evaluate the technical and economic viability of solar photovoltaics (PV) and battery energy storage to cost-effectively reduce the Island's peak electrical demand. The request was approved by NREL's Solar Technical Assistance Team (STAT), who worked with the Town's Energy Coordinator to:

1. Review material regarding the issue of the Nantucket peak electric demand as well as a recently terminated PV project proposed by Honeywell for the Nantucket Memorial Airport as part of the externally-funded "Carbon Neutral Airport Program";
2. Conduct an analysis to evaluate the economic viability of PV on Nantucket; and
3. Evaluate the technical potential of PV and battery energy storage to reduce the Island's peak demand.

The report was finalized in early October (attached) with helpful findings and recommendations as the Town further pursues Solar-PV and Energy Storage opportunities. Of significance, the analysis shows:

- The price of electricity from a third-party-owned PV project is expected to be below the current and forecasted price of utility-provided electricity for the Town. Additionally, the analysis shows that the impact of the Federal Investment Tax Credit (ITC) reduction from 30% to 10% at the end of 2016 equates to an increase of about $0.03/kWh in the price of electricity.
- Large-scale deployment of PV alone will not have a significant impact on Nantucket's peak electrical demand. However, PV combined with battery energy storage can contribute to a reduction in the peak demand.
- Smaller-scale PV projects could provide the Town of Nantucket with between $1 million and $2 million net present value of avoided utility costs.

The Energy Office believes this analysis will provide the critical data and reasoning needed to strengthen Nantucket's case to be considered for an energy storage demonstration pilot project as part of the $10Million *Energy Storage Initiative* (ESI) currently being investigated by the Massachusetts Department of Energy Resources (DOER) and the Massachusetts Clean Energy Center (MassCEC).

b. Airport Solar PV Investigation

The Energy Office, with support from Town Administration and the Nantucket Memorial Airport, is presently investigating the feasibility of developing a 2-MW of solar photovoltaics (PV) on Airport land previously identified by "Carbon Neutral Airport Program (the CNA Program)." Our present efforts originated after the CNA Program was terminated by the Airport Commission in August, 2015, with the intent of determining whether development of a solar PV facility at the identified site might still be feasible despite known challenges.

As a first step in the investigation, on September 9, 2015 the Town Energy Office circulated a written description of the project to over twenty New England-based solar developers in order to assess the level of interest in developing the project despite the challenges that have been identified to date (attached). Over a dozen reputable solar developers quickly responded to express their interest, notwithstanding the aggressive timeline for project completion. The key schedule constraints include the following:

1. For the project to be economically viable, the system must be interconnected and producing power by December 31, 2016 in order to qualify for the 30% federal Investment Tax Credit (ITC). However, the interconnection study performed for National Grid, in March, 2015, estimated that the construction of the interconnection would require a schedule of 16-18 months. The project is not economically feasible for private development under current conditions unless National Grid can compress this schedule to meet the deadline for qualification for the ITC.
2. Any form of the project that involves a long-term sale of electricity or net metering credits to the Town of the Airport will require approval at Town Meeting in April 2016 – which allows very little time to procure a vendor, define the project and negotiate the agreements that would need to be approved at Town Meeting.
3. The Site will require completion of mitigation arrangements with the Natural Heritage & Endangered Species Program (NHESP) and the Land Bank, as well as review by the HDC, in both cases preferably prior to Town Meeting.

One way that the project development schedule might be expedited would be for the Town to become a member of PowerOptions. PowerOptions is an energy buying consortium created in 1996 by the Massachusetts Health and Education Facilities Authority (HEFA) to help nonprofits and municipalities to consolidate their energy buying influence. PowerOptions energy programs are offered to public agencies on behalf of the Massachusetts Clean Energy Center (MassCEC), under MGL Chapter 164, Section 137 (attached). To facilitate development of solar PV facilities by its membership, in 2011, PowerOptions, selected SunEdison as their solar PV program vendor after conducting a robust and competitive procurement process that involved over a dozen vendors. The solar program and related contracts are offered to PowerOptions members through December 2016. Town Counsel is familiar with the PowerOptions Solar Program and has stated to Town Energy Office staff that the Town could, by becoming a member of PowerOptions, immediately engage Sun Edison as its solar PV project developer, thereby greatly shortening the time that would otherwise be required to select a vendor through its own competitive RFP process. There may be no other way to achieve the required schedule to make the project feasible under current conditions.

In exchange for a nominal membership fee ($1,600/year), the Town of Nantucket would also benefit from PowerOptions' pre-negotiated Power Purchase Agreement (PPA) for both on-site and virtually net metered solar power, saving critical time and money. The PPA would fix the basis for the electricity price for 20 years, with no technical responsibilities for the Town or Airport. SunEdison would manage all aspects of project design, preparation of permit applications, completion of interconnection arrangements, financing, construction and operations and maintenance. As a result, the Energy Office identified and requested funds from the District Local Technical Assistance (DLTA) program of the Nantucket Planning & Economic Development Commission (NP&EDC) for the Town's membership fee to join PowerOptions, which were unanimously approved by the NP&EDC on October 4, 2015.

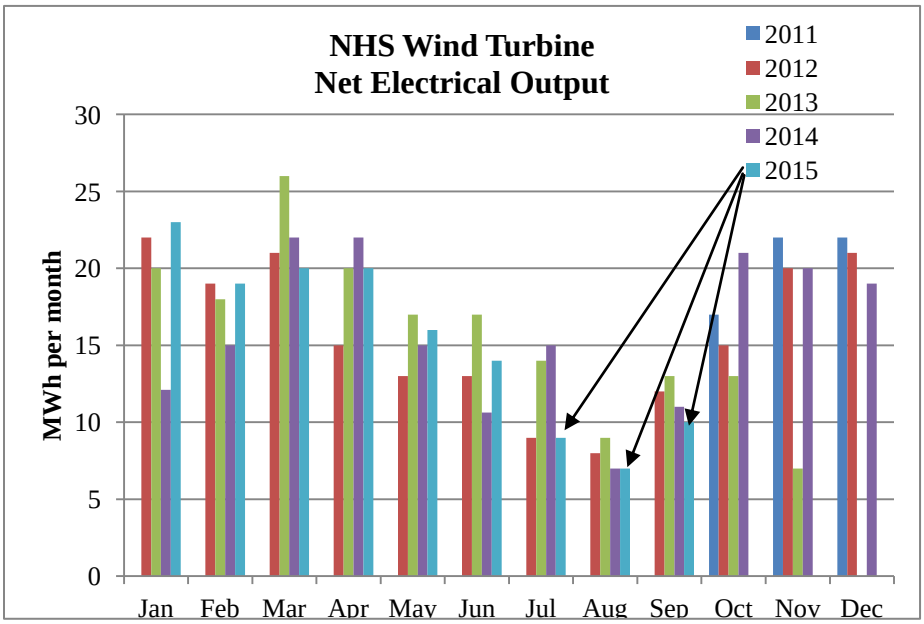
Since then, the Energy Office has begun to engage with SunEdison, and expects their engineering team to visit Nantucket in the next few weeks to assess the Airport site and present the Town and Airport with feasible options for project designs and contract costs. Sun Edison will also evaluate whether the site might be developed as a "Community Shared Solar" project (see Foxboro article). In addition, Sun Edison would take responsibility for completing the Site mitigation and permitting processes.

Concurrently, the Energy Office is seeking commitment from National Grid to expedite the planning and construction of interconnection system modifications. Even under this expedited approach, successful timely actions on all these fronts would be needed for the project to be operational by the end of 2016. While a project may still be possible after December 31, 2016, when the ITC decreases from 30% to 10%, the NREL analysis indicates that this will result in an increase of about $0.03/kWh in the price of electricity from a third-party-owned PV project.

In the meantime, the Energy Office has been in contact with the Towns of Pembroke and Foxboro regarding their experiences working with PowerOptions and SunEdison and has only received positive feedback to date.

4. Nantucket High School Wind Turbine update. The 100kW wind turbine at Nantucket High School has generated 751MWh since it began operation in October of 2010. This equates to approximately $150,000 in avoided electricity costs and $49,784.25 in Class 1 Renewable Energy Certificate (REC) sales.

In Q1 of FY2016, the turbine generated 26 megawatt hours (MWh), a decrease from 33 MWh in Q1 of FY2015, which can be somewhat attributable to the turbine being out of operation for a week in July and September.



Community-Wide Energy Initiatives

1. Community Choice Aggregation (CCA)/Municipal Aggregation

It is the Energy Office's recommendation that the Town of Nantucket further explore the development of a municipal aggregation by issuing an RFP for an aggregation consultant to evaluate the feasibility of deploying a CCA in the best interests of Nantucket ratepayers. The RFP is scheduled to be publically issued by the Town's Procurement Officer later this month (October 2015).

2. Mass Save Energy Efficiency Program: Residential & Business Energy Assessments

In the calendar year to date, the Energy Office has worked with National Grid and Mass Save to publicize, schedule and arrange no-cost home energy assessments for **449** Nantucket households during five separately coordinated "Mass Save Home Energy Assessment Week(s)," which puts us well above our goal of 400 assessments by the

year's end. Appointments for the last Mass Save week of the calendar year, November 2-5, are already filling up. Mass Save will not return again until March 2016, at which point energy audit weeks will take place every other month (6 weekly visits per year).

- Since January 2015:
  - **449 Home Energy Assessments were performed**
  - 162 wifi thermostats (+$200 value)
  - 64 dehumidifiers ($200 value)
  - 54 Hybrid electric Heat-pump Water Heaters ($3,000 value)
  - 830 Powerstrips installed
  - 20, 247 LEDs installed
  - 246 Programmable thermostats installed
  - 587 Low-flow showerheads installed

- The next scheduled residential and small business energy audits will take place:
  - **November 2-6, 2015 (20 Red Tickets per Assessment)**
  - **March 2016 (TBD)**

- Increased marketing and PR to promote the Mass Save program as part of the "Non-Wires Alternative (NWA) Project" to defer the need for costly and disruptive infrastructure investments:
  - Energy Awareness Event for Community Leaders/Stakeholders (July 29)
  - Increased radio announcements and interviews
  - Tabling at downtown Farmers & Artisans Markets, St. Paul's Church Fair (July 15), Elder Expo (September 12), Island Fair (September 13)
  - Window air conditioner recycling event at the Nantucket Emporium on Friday, September 4. (15 Units dropped off for recycling)
  - Refrigerator Recycling Pick-up on September 14, 2015 (14 refrigerators picked up for recycling)

Other Projects (Research)

From October 26 until mid-December, the Energy Office will sponsor and serve as project advisor to three undergraduate engineering students from Worcester Polytechnic Institute. This project will be the fifth research project that the Energy Office has sponsored in recent years, focused on local energy issues. This year's project is detailed below:

WPI Project – "Analyzing Energy Awareness, Attitudes, and Alliances on Nantucket"
Sponsored by the Town of Nantucket Energy Office,
with assistance from National Grid and reMain Nantucket

Purpose: To provide key research, recommendations, and deliverables—based on local interviews, surveys, and lessons learned from the City of Worcester's smart grid pilot project and local Sustainability Hub—to support the Town of Nantucket Energy Office and National Grid in their efforts to increase the public's energy awareness and participation in local energy programs designed to save Nantucket residents and businesses energy and energy-related costs, such as Municipal Aggregation and the "Non-Wires Alternative" (NWA) pilot project to reduce summer peak load and defer the need for a third undersea transmission cable.

Goals:

- Recommend ways to increase public awareness and participation in energy efficiency programs, including the role of a community "Sustainability Hub"

- Identify areas where the public's knowledge of local energy issues and programs exists and where more education is needed
- Identify relevant "lessons learned" from the city of Worcester's experience with smart grid, demand response, and energy efficient technologies
- Determine the attitudes of the Nantucket population towards various energy saving programs and technologies, and compare these sentiments against those of certain Worcester residents, where appropriate and useful
- Identify and initiate relationships with local stakeholders (individuals and organizations) who can support the goals of the Town Energy Office and National Grid

Overview:
In recent years, Nantucket's demand for electricity has increased significantly. On July 23 2013, Nantucket's energy usage hit an all-time high: 45 MW, a 12.5% increase from the previous record high of 40MW in 2012. National Grid, the island's sole electric utility, has determined that Nantucket's demand for electricity is growing more than five times the Massachusetts state average. As a result, there is a growing concern about the need for additional, costly and disruptive infrastructure--namely a 3rd undersea transmission cable, which may come at a tremendous expense to Nantucket ratepayers.

Nantucket residents and businesses pay some of the most expensive energy prices in the country. Not only are National Grid's basic supply charges subject to extreme price volatility (e.g. Nantucket residential supply rates nearly doubled during the winter of 2014-2015), but Nantucket ratepayers are also subject to monthly electric bill surcharges:

- A "Cable Facility Surcharge" that funds the existing two undersea cables, (Summer: 2.190¢ per kWh/ Winter 1.254¢ per kWh); and an
- Energy Efficiency Charge (1.004¢ per kWh), to fund the Mass Save program, which equates to about 1.46 Million dollars/year from Nantucket ratepayers. Currently, Nantucket is only receiving 17% back of this funding for energy efficiency investments.

While the reality of the need for a 3rd cable on Nantucket is still uncertain, there is much that can be done to reduce electricity costs and improve the overall energy efficiency of the island's residences and businesses. Not only is the Town investigating Municipal Aggregation to potentially reduce electric rates, but has teamed up with National Grid on a special 5-year "Non-Wires Alternative" (NWA) pilot project to investigate whether customer-side technologies can be implemented in a targeted way to achieve sustainable load reductions, possibly reducing the amount of backup diesel generation needed and potentially deferring any future plans to construct a 3rd cable. The Project was launched in 2015, with the initial phase focusing on a set of "exclusive" energy efficiency incentives for Nantucket customers.

Deliverables:
The Project has several study components that will provide key field research, information and recommendations for how the Town and National Grid can be most effective in their public outreach and education efforts to promote programs designed to reduce Nantucket's summer peak load and to save Nantucket residents and businesses energy and energy related costs through energy efficiency, conservation, and electricity aggregation programs. Students will:

1) **Identify where energy awareness exists and where it's gaping, on topics such as:**
   - Electricity supply options/ Municipal Aggregation
   - How electricity is delivered to Nantucket (2 undersea cables); and increasing need for 3rd cable and its inherent consequences

- If and how the need for a 3rd cable could be deferred
- Island-wide electricity growth rate
- HDC obstacles to renewable energy, energy efficiency
- Mass Save offerings/Energy Efficiency Surcharge
- Local energy resources available (Energy Office, Greenhound Sustainability Hub)

2) Determine attitudes and degrees of receptiveness towards:

- Municipal Aggregation
- Concept of Demand Response
- Importance of energy efficiency (individual and collective)
- Solar PV (municipal and personal vs. neighbors)
- Offshore Wind
- Town renewable energy projects
- Ice Energy: Thermal Storage/Hybrid AC units
- National Grid/Town of Nantucket

3) Recommend ways to maximize PR and the disbursement of key energy information:

- Role of the Greenhound Sustainability Hub
- Increased social media exposure and influence
- Produce a helpful literature for placement in Town buildings and in the community
- Create a "Green Business" Recognition Program in association with local Chamber of Commerce
- Recommend a suitable role for a volunteer Energy Committee

4) Interview key contacts within the Town government, business community, and key stakeholders to assess partnership and alliance opportunities

Massachusetts Electric Company
Nantucket Electric Company

Summary of Proposed Basic Service Charges
Including Basic Service Administrative Cost Adjustment Factor and Smart Grid Customer Cost Adjustment Factor
November 2015 through April 2016

				Zonal Basic Service Charges			
		Residential (R-1, R-2, R-4, E)	Commercial (G-1)	NEMA Industrial (G-2, G-3)	SEMA Industrial (G-2, G-3)	WCMA Industrial (G-2, G-3)	Commercial (Streetlights)
		(a)	(b)	(c)	(d)	(e)	(f)
	Section 1: Variable Basic Service Charges, ¢/kWh						
(1)	November 2015	11.318	11.146	9.864	9.774	9.309	11.146
(2)	December 2015	13.478	13.126	12.404	12.407	12.062	13.126
(3)	January 2016	15.238	14.838	14.656	14.841	14.782	14.838
(4)	February 2016	15.105	14.527	n/a	n/a	n/a	14.527
(5)	March 2016	12.088	11.861	n/a	n/a	n/a	11.861
(6)	April 2016	10.390	10.161	n/a	n/a	n/a	10.161
	Section 2: Fixed Basic Service Charge, ¢/kWh						
(7)	November 2015 through April 2016	13.129	12.709				12.709
	November 2015 through January 2016			12.410	12.448	12.167	

(1) R-1,R-2,R-4: Page 2, Line (15), Column (a)
G-1: Page 3, Line (15), Column (a)
NEMA G-2,G-3: Page 4, Line (15), Column (a)
SEMA G-2,G-3: Page 5, Line (15), Column (a)
WCMA G-2,G-3: Page 6, Line (15), Column (a)
Streetlights: Page 3, Line (15), Column (a)

(2) R-1,R-2,R-4: Page 2, Line (15), Column (b)
G-1: Page 3, Line (15), Column (b)
NEMA G-2,G-3: Page 4, Line (15), Column (b)
SEMA G-2,G-3: Page 5, Line (15), Column (b)
WCMA G-2,G-3: Page 6, Line (15), Column (b)
Streetlights: Page 3, Line (15), Column (b)

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G-1: Page 3, Line (15), Column (c)
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SEMA G-2,G-3: Page 5, Line (15), Column (c)
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Streetlights: Page 3, Line (15), Column (c)

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SEMA G-2,G-3: Page 5, Line (15), Column (e)
WCMA G-2,G-3: Page 6, Line (15), Column (e)
Streetlights: Page 3, Line (15), Column (e)

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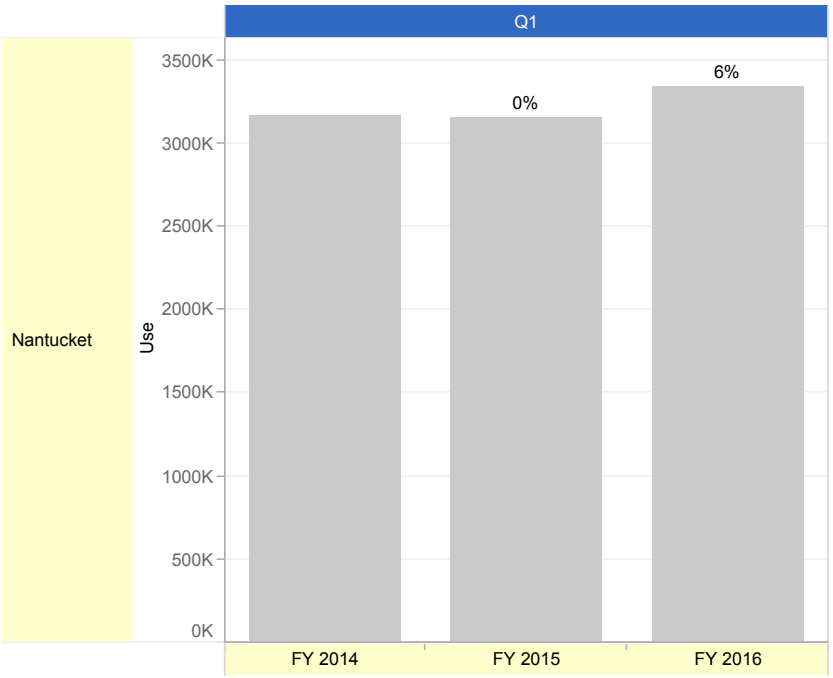
WCMA G-2,G-3: Page 6, Line (15), Column (g)
Streetlights: Page 3, Line (15), Column (g)

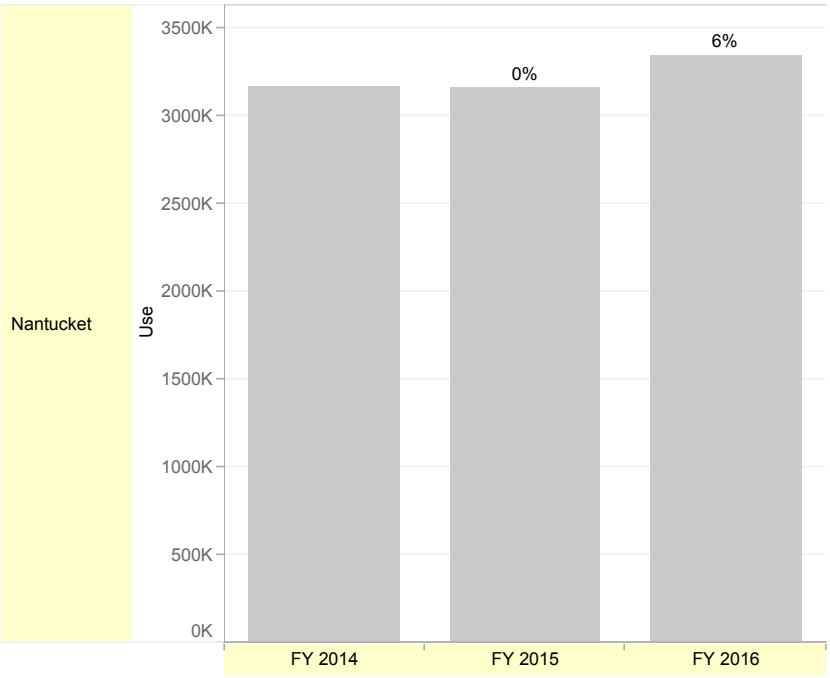
Monitoring Use Dashboard

Compare use for any quarter to previous quarters, or for any year to previous years. Percent difference is calculated from previous period. To collapse or expand the charts, hover over the names of your City, Departments, Buildings, etc., then click the plus (+) or minus (-) symbols at the top of the columns.

Quarter to Quarter



Year to Year



% Difference in Use

-50% 50%

Fuel (units)
Electric (kWh)

Category
All

Subcategory
All

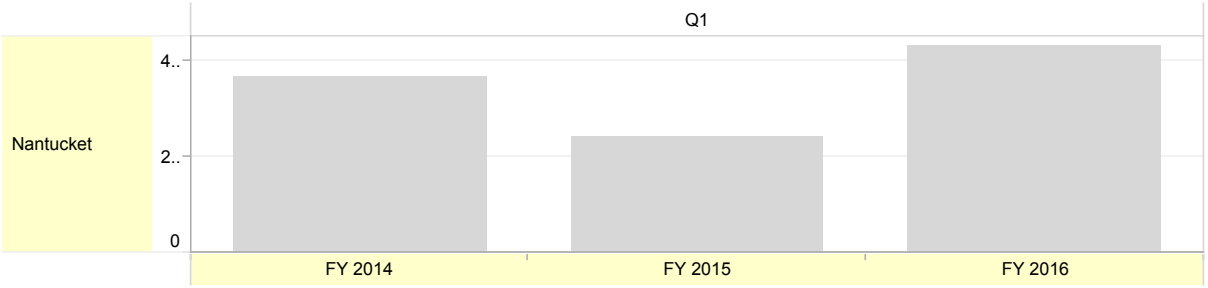
Department
All

Year
Multiple Values

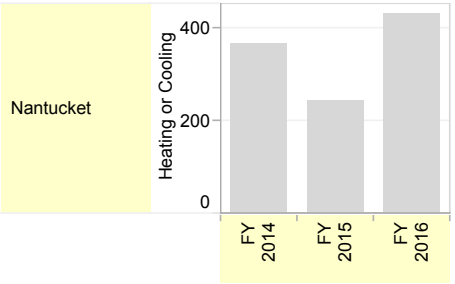
Quarter
- [x] Q1
- [ ] Q2
- [ ] Q3
- [ ] Q4

Show Heating or Cooling Degree Days
Cooling

Cooling Degree Days Quarter to Quarter



Cooling Degree Days Year to Year



Heating or Cooling Degree Days for your local weather station are shown for your information, usage data has not been normalized. See the FAQ for more info: http://massenergyinsight.net/faq#degree_days

NATIONAL RENEWABLE ENERGY LABORATORY

Date: Friday, October 09, 2015

To: Lauren Sinatra, Energy Coordinator; Town of Nantucket

From: Solar Technical Assistance Team

Subject: Benefits of Photovoltaics and Energy Storage to the Town of Nantucket and the Nantucket Electric Utility Rate Payers

Ms. Sinatra,

Thank you for your request to the Solar Technical Assistance Team (STAT). STAT is a project of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Solar Balance of System Costs subprogram, and it is implemented by the National Renewable Energy Laboratory (NREL). The purpose of STAT is to provide credible and timely information to inform policy or regulatory discussions around solar technology deployment.

Through the STAT Quick Response program, the Town of Nantucket (Town) requested assistance to evaluate the technical and economic viability of solar photovoltaics (PV) and battery energy storage to cost-effectively reduce the Island's peak electrical demand. This request was prompted by the recent collaboration between the Town of Nantucket Energy Office (NEO) and the electrical distribution company serving Nantucket, National Grid. National Grid is working with the NEO to develop a strategy and implement solutions to manage electrical demand to avoid or defer significant investment in transmission and distribution system upgrades. In response, NREL did the following: 1) reviewed material provided by the NEO regarding the issue of the Nantucket peak electric demand as well as a recently terminated PV project proposed for the Nantucket Memorial Airport as part of the externally-funded "Carbon Neutral Airport Program," 2) conducted an analysis to evaluate the economic viability of PV on Nantucket, and 3) evaluated the technical potential of PV and battery energy storage to reduce the Island's peak demand. National Grid is evaluating a variety of options to address the Island's growing electrical demand to ensure reliable electrical service, but this response focuses on PV and battery energy storage.

Several NREL staff members contributed to the development of this document, including Dan Olis, Tim Tetreault, Kari Burman, Erin Nobler, Sam Booth, and Kate Anderson.

Background

The island County of Nantucket, MA, is located approximately30 miles off the southern coast of Cape Cod, MA. The population of Nantucket varies dramatically throughout the year, with about 10,500 year-round residents; an influx of tourists and seasonal residents during the summer months causes a surge in the population to over 50,000.[1] With this influx comes an increase in electricity demand, which in recent years has pushed the limits of the existing electrical infrastructure. The Island's electricity is supplied by two undersea cables owned and operated by the National Grid utility, funded by a monthly "Cable Facility Surcharge," paid by all Nantucket ratepayers. Figure 1 shows an illustration of the undersea cables serving Nantucket. Cable 1 and Cable 2 have rated capacities of 38 and 36 megawatts (MW), respectively. Each cable serves about half of the electric demand under normal operating conditions. In addition to the two undersea cables, National Grid owns and operates two 3-MW diesel generators at its Bunker Road facility on Nantucket to serve as backup in the event that one of the cables is compromised. If one of the undersea cables were to fail during the peak electric load in the summer months, the other cable would be unable to serve the entire Island's load; the on-Island generators and emergency roll-on generators would be used to compensate for the lost capacity.

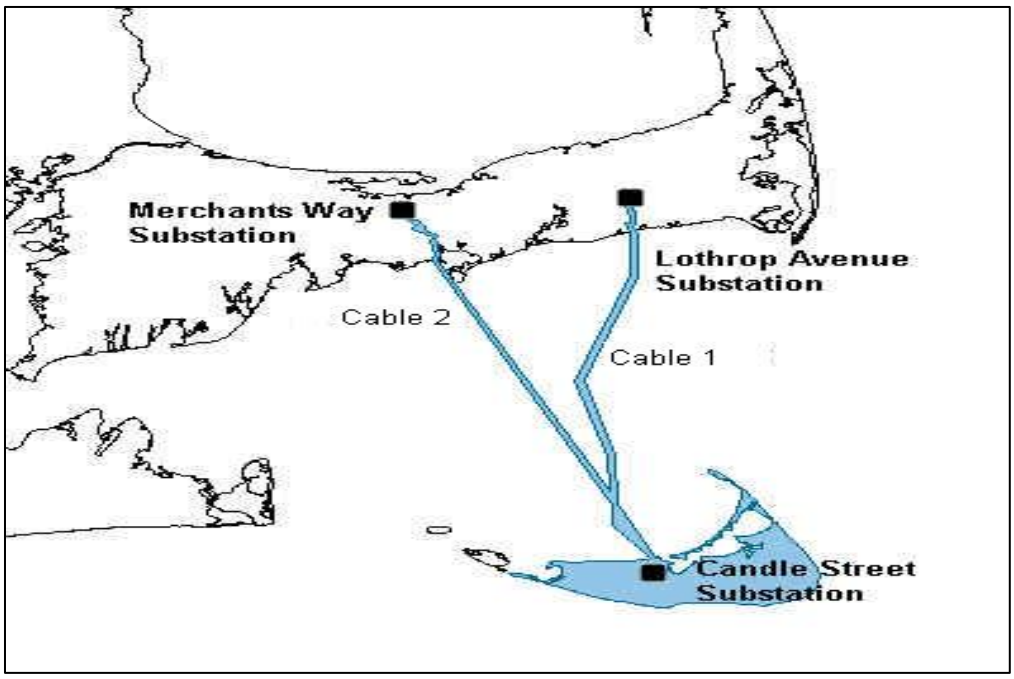


Figure 1. Undersea cables serving Nantucket.
Source: National Grid Energy Forum presentation, September 22, 2014.

In the summer of 2013, Nantucket's electrical demand hit an all-time high—45 MW[2]—a 12.5% increase from the previous record high in the summer of 2012. Nantucket has experienced high electrical load growth in recent years and is expected to continue this trend over the next 15

[1] "Nantucket," Wikipedia, accessed September, 15, 2015, https://en.wikipedia.org/wiki/Nantucket
[2] Early reports of the 2015 peak demand indicate a slight increase over the previous all-time high from in 2013.

years, according to National Grid projections.[3] Table 1 shows the historical and forecasted electrical load growth for Nantucket.

Table 1. Historical and Forecasted Annual Electric Load Growth

Annual Growth	Nantucket (%)	State (%)
Historical 5-Year Average	3.6	0.6
5-Year Forecast	3.2	1.1
15-Year Forecast	2.2	0.8

In Figure 2, the forecasted load growth is shown in terms of peak demand relative to the capacity of the undersea cable and existing generation. The figure is taken from National Grid's presentation cited earlier. The peak demand in 2013 reached the capacity of Cable #1 plus the existing 6 MW of on-Island generation capacity. The current contingency plan in the event of a cable failure is to increase the on-Island generation via roll-on generators. National Grid's forecasted load growth shows a steady increase in peak demand, which requires that additional roll-on generation capacity be available in the event of a cable failure during the summer months of peak demand. National Grid's current contingency plan is to use the existing generators plus up to six additional roll-on generators at the Bunker Road facility and six at the Candle Street substation.

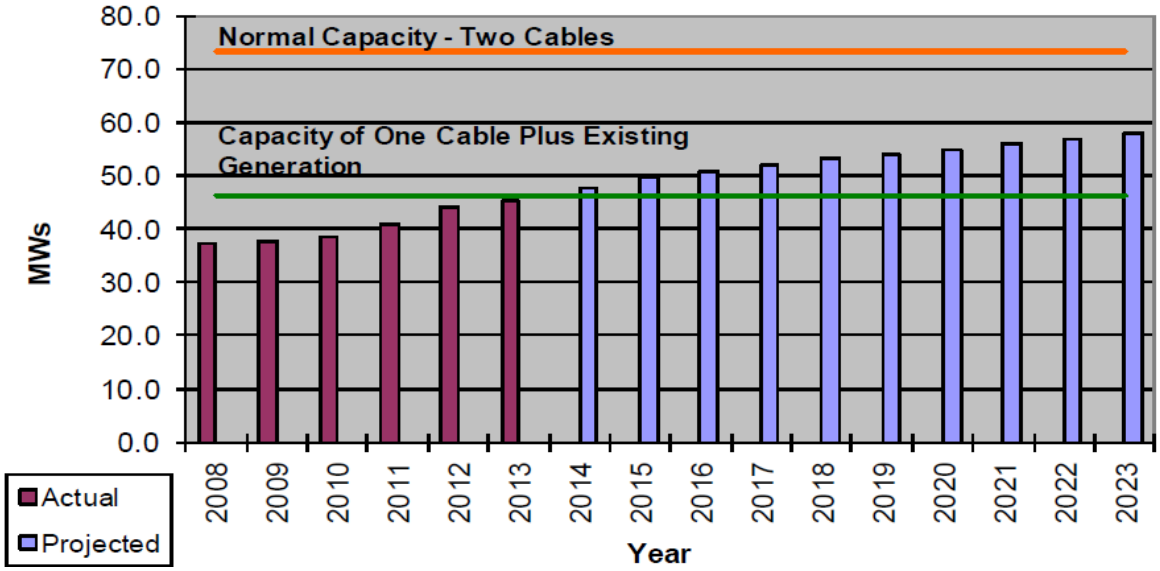


Figure 2. Nantucket Load – Cable #1 failure

Another load metric that National Grid monitors is the frequency and duration that the load exceeds the capacity of a single cable, referred to as the "contingency threshold"—the load

[3] Tim Roughan, Lindsay Foley, Emily Slack, "Working Together Toward a Sound Energy Future: Long Term Energy & Sustainability Planning on Nantucket," Presentation by National Grid to the Nantucket Energy Office, September, 2014.

above which the existing contingency plan would be deployed if one of the cables failed. The calculation assumes that the larger-capacity cable fails, and therefore, the limit of the contingency threshold is 36 MW, which is the capacity of the smaller cable. Figure 3 shows the number of hours that the peak demand is above the contingency threshold, by hour of the day, from 2008 through 2013. This chart recreates a chart from the National Grid presentation to the Town of Nantucket cited earlier and shows the Island's electric demand growth—both in the total number of hours above the contingency threshold and in the hours of the day that the threshold is exceeded. In 2008, the threshold was exceeded for 3 hours only during the hours of 7 pm and 8 pm. In 2013, the threshold was exceeded for 249 hours in total and also during more hours of the day, from 10 am to midnight.

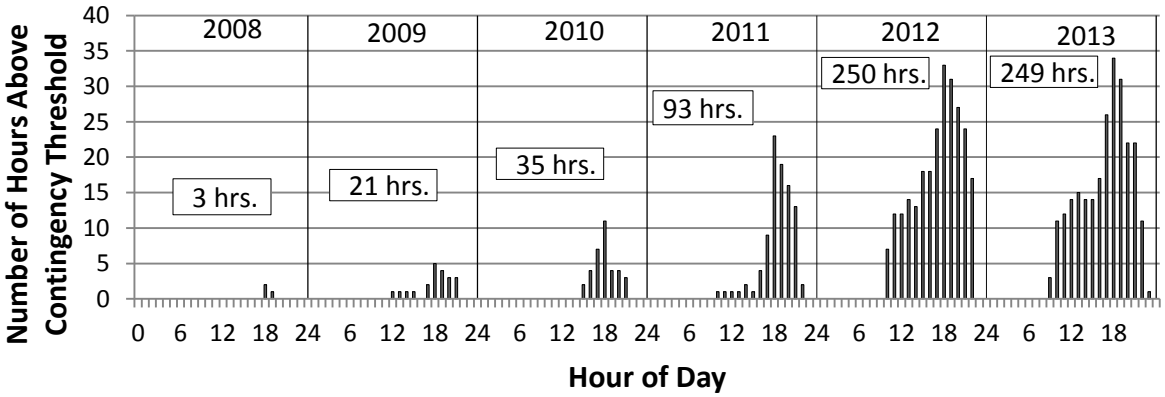


Figure 3. Number of hours above contingency threshold by hour by year

The current and forecasted load profile for Nantucket poses challenges for National Grid to maintain a sufficient level of reliability. The primary concern is maintaining service in the event of a supply cable failure. Although a cable failure is an unlikely event, it is one for which National Grid needs to maintain a contingency plan that will minimize disturbances to its electric service. National Grid and the NEO are working to develop solutions to cost-effectively manage the load growth so as to avoid or defer the costly investment in a third undersea supply cable. National Grid is conducting ongoing analysis to evaluate the impact of current and planned initiatives that will, in turn, inform their long-term planning related to the need and timing of a third cable. Energy efficiency is a main component of the strategy, with additional considerations including renewable energy, grid modernization, load management, additional on-Island diesel generation, rate structures, battery storage, thermal storage, and user-owned generation.

This memo includes an analysis of the economic viability of PV for the Town of Nantucket and evaluation of the technical potential of PV and battery energy storage to reduce the Island's peak demand. National Grid is evaluating a variety of options to address the Island's growing electrical demand to ensure reliable electrical service. However, this technical assistance only focuses on how PV and battery energy storage contribute to the multipronged strategy.

Question One: Is PV Economically Viable on Nantucket?

Regardless of the potential benefit of PV on the Island's peak demand issue, PV is an established technology that is broadly deployed throughout the U.S. and internationally. The state of Massachusetts has one of the more aggressive PV goals within the U.S.—to integrate 1,600 MW of PV by 2020. Accordingly, a combination of incentives exists to encourage development of PV projects throughout the State.

The net-metering rules in Massachusetts limit total installed capacity on a given system to some fraction of the utility's peak load. There are different total installed capacity net-metering limits for "private" and "public" customers. For Nantucket, the total installed capacity allowed for the Town under the public customer category is 2.273 MW. The Town currently has a 0.1-MW (100-kW) wind turbine installed at the Nantucket high school, so the Town could install up to 2.173 MW (2173 kW) of additional net-metering facilities.

The net-metering policy in Massachusetts allows utility customers to install a system that generates more electricity than can be consumed at the site and assign excess generation to other meters not located at the facility. This would allow the town to install a system that is larger than the load at a location if Nantucket has a desire for a larger system and the facility has the space to host it.

In addition to net metering, Massachusetts also has a solar renewable energy credit (SREC) incentive that creates a market for SRECs generated. This market allows PV system owners to sell renewable energy credits generated by their system to make projects more economically attractive. Massachusetts' SREC program, currently call SRECII, is described in detail at this link: http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/. The program defines four project categories (Market Sector A, B, C and Managed Growth) based on several factors including installation type (ground-mount, rooftop, or carport), site (landfill or brownfield), on-site load, and system size. Each category is assigned an SREC factor to apply to the sale price of the SRECs generated by the project.

Based on a review of the criteria for SREC II price-factor eligibility, for this economic analysis, we assume the system will qualify for Massachusetts' SREC II Market Sector B incentive with a 0.9 SREC factor. We based this determination on the assumption that the Town has one or more sites with available land to host a PV array and on-site electrical demand is equal to at least 67% of the PV system output on an annual basis. Otherwise, to qualify for the SREC II program, projects would either need to be developed as a Community Shared Solar (CSS) program; have a capacity of less than 650kW; or qualify as part of the Mass DOER's Managed Growth program.

Based on its high on-site electrical demand, one potential Town facility to host a PV project is the Surfside wastewater treatment plant (WWTP). A recent WWTP utility bill shows that the electricity consumption at the facility was 2,360 MWh for the 12-month period from September of 2014 through August of 2015. We assumed that 1 MW_{DC} of PV will generate 1,225 MWh of electricity in its first year of operation (estimated using NREL's PVWatts tool and Nantucket Memorial Airport weather file). After applying the 67% rule, a 2.87-MW_{DC} system could be installed at the facility and still qualify for SRECII as Market Sector B. Because this exceeds the available capacity of the net-metering limit, the system size at the treatment plant is capped at

2.17 MW. This would produce about 2,658 MWh in the first year and about 89% would be consumed by the WWTP facility and the rest would be credited to other Town of Nantucket electricity bills. If there is insufficient land to host a large PV array at the WWTP, the Town could consider a project that combines smaller PV systems developed on multiple Town properties. This approach could benefit from economy of scale and efficiency of effort by conducting a single procurement for multiple PV systems while maximizing the incentives from the SREC II program. A review of satellite images and information provided by the NEO indicate land area may be available for PV development at the Airport, landfill and water company property.

The cost-benefit analysis assumes that the Town of Nantucket would procure PV-generated electricity through a power purchase agreement (PPA) with an independent power producer (IPP), rather than the Town owning and operating the system itself. Contractual agreements such as these are common and preferred by some people for the following reasons:

- The beneficiary, or off-taker of the system, does not need to make a large capital outlay as investment.
- System performance and SREC price risk is on the IPP, the system owner, not the off-taker, which, in this case, is the Town of Nantucket.
- Operations and maintenance are the responsibility of the owner and the owner is motivated to maximize system performance to maximize revenue of electricity sales.
- Third-party ownership allows the PV project to take advantage of tax deductions and tax credits that the town would not be able to take if Nantucket were the system owner. The investment tax credit (ITC) is 30% of capital costs for projects with commercial operation dates by December, 31 2016. After this date, the ITC drops to 10%.

The cost-benefit analysis for the Town of Nantucket was done in two parts:

1. The project is evaluated from the IPP's perspective to estimate the price that the IPP needs to charge Nantucket for the electricity produced by the system so that the IPP is able to recover all costs of ownership as well as earn a return on investment over term of the power purchasing contract.
2. The project is evaluated from the Town of Nantucket's point of view. Given the price of electricity that the IPP needs to charge for the project, is it a "good deal" for Nantucket? That is, will Nantucket save money by buying some of its electricity from an IPP that owns a PV system on Nantucket?

PPA contracts are typically 20 to 25 years. This analysis assumes that the PPA has a 25-year term and the IPP earns 8% on the project, which is a reasonable return for these types of projects. The analysis also assumes that the IPP monetizes the SRECs. Further, it assumes that the Town of Nantucket does not charge the IPP for use of the land that the system would occupy. If there were land lease costs, they would be recovered by the developer in the PPA price, inflating the cost of energy to Nantucket.

The analysis projects a PPA price in the range of \$0.103/kWh to \$0.135/kWh, with no cost escalator over the 25-year term. The analysis assumes an installed cost of \$2.55/W_{DC}, which is

conservative for large utility-scale projects on the U.S. mainland. Cost adders for working on Nantucket were not specifically estimated and modeled. Instead, we assumed a less aggressive (i.e., less optimistic) cost for the system.

The key assumptions for estimating the PPA price are as follows:[4]

- Production model: PVWatts
- PV nameplate capacity: 2200 kW_{DC}
- Inverter: 2000 kW capacity, 96% efficiency
- Array type: ground-mount, fixed orientation, facing due south, 20-degree tilt
- System losses: 14%
- Annual performance degradation rate: 0.5%/year
- Weather file: Nantucket Memorial Airport (TMY3)
- 25-year term
- Weighted Average Cost of Capital (WACC): 8%
- Installed cost: $2.55/$W_{DC}$
- Operations and maintenance (O&M): $20/$kW_{DC}$/year with 2.5%/year inflation rate
- No-cost land lease between the Town of Nantucket and the IPP
- Federal tax rate: 28%
- Sales tax: 5%
- Insurance rate: 0.5%/year
- Property tax rate: 2%/year of assessed value
- Federal depreciation: 5-year modified accelerated cost-recovery system (MACRS)
- State depreciation: 5-year MACRS
- Investment tax credit (ITC): 10% (if installed after end of 2016), 30% (if installed before end of 2016). Results are presented with both ITC values to show the impact on the projected PPA rate.
- SREC: $0.1935/kWh for 5 years
- SREC program: Massachusetts RPS Solar Carve-Out II program. Assumes that the project earns 90% SREC value based on SREC II Market Sector B category. Eligibility based on ground-mounted system with greater than 67% on-site consumption (http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/about-solar-carve-out-ii.html)
- SREC price estimate per the following reference for 2017: http://www.srectrade.com/blog/wp-content/uploads/2015/04/2015_04_02_SRECTrade_SREC_Markets.jpg

The second part of the analysis estimates what the net impact of the PPA is on the Town of Nantucket's operating costs for electricity. Current costs of electricity delivered by National Grid were taken from a utility bill provided by Nantucket for the Town's Surfside waste-water treatment plant. Utility-purchased electricity costs are assumed to increase 1% per year over the 25-year analysis period, slightly above the 0.8% rate projected by the U.S. Energy Information

[4] The techno-economic analysis was done using NREL's System Advisor Model (SAM). Documentation on the model and resources for SAM are provided here: https://sam.nrel.gov/

Agency for New England. Cost escalation rates are difficult to predict, but the value was rounded to the nearest whole value because costs on Nantucket may rise at a faster rate due to the utility's needs to address capacity issues described earlier in this report.

The results are shown in Table 2. The analysis shows that for the projected PPA price range of $0.103 to $0.135/kWh, the Town of Nantucket would save between $32,000 and $118,000 per year on total electricity costs (utility costs net PPA costs). Over the assumed 25-year contract term, the Town would save about $1 million to $2 million in present-value terms assuming a 5% discount rate.

Table 2. PV PPA Cost-Benefit Analysis

PPA price case	Low (30% ITC)	High (10% ITC)
PPA rate	$0.103/kWh	$0.135/kWh
Purchased PV electricity, Year 1	2,695,438 kWh	
Avoided utility costs, Year 1	$395,434	
PPA expenditures, Year 1	$277,630	$363,884
Utility savings, Year 1	$117,804	$31,550
Net-present value over 25 years	$2,112,000	$952,590

The assumptions in the cost-benefit analysis are as follows:

- PPA price escalation rate: 0% per year (no annual escalation rate)
- PPA term: 25 years
- Discount rate: 5% nominal
- Electric utility rate tariff: National Grid Time-of-Use G3
- Utility electricity costs: $0.149/kWh on-peak, $0.142/kWh off-peak
- On-peak hours: Weekdays, 8 am to 9 pm
- Demand charges not considered
- Utility cost escalation rate: 1%/year
- Net metering: Yes. Site load is at least 67% of total PV system annual production (policy requirement)

The analysis shows that the price of electricity from a third-party-owned PV project is expected to be below the current and forecasted price of utility-provided electricity for the Town. Additionally, the analysis shows that the impact of the ITC reduction from 30% to 10% equates to an increase of about $0.03/kWh in the price of electricity from a third-party-owned PV project.

Question Two: How Would PV and Battery Energy Storage Contribute to the Reduction of Nantucket's Peak Demand?

To answer this question, we collected and analyzed hourly electrical demand data for the Island and established a baseline load profile for 2013. From the baseline, we developed a projected load profile for 2028 based on National Grid's 15-year forecasted annual load growth rate for the Island of 2.2%. The projected nominal load profile for 2028 was generated by assuming a 2.2%

annual growth rate applied equally to each hour of the day. We developed a model using the SAM tool and conducted scenario analyses to calculate the Island's projected electric demand assuming the integration of large-scale PV and battery energy storage. The projected nominal load profile for 2028 was compared to the modeled load profile with PV and battery energy storage to illustrate the relative impact of these technologies on the Island's peak electricity demand.

Load Profile

The Island's load profile is characterized by dramatic daily and seasonal fluctuations. Figure 4 shows Nantucket's average daily load profile and peak demand by month for 2013. July and August show a significant increase in demand that coincides with the influx of summer travelers and seasonal residents. The contingency threshold is exceeded in July and August, with peak demand of about 43 MW and 37 MW, respectively.

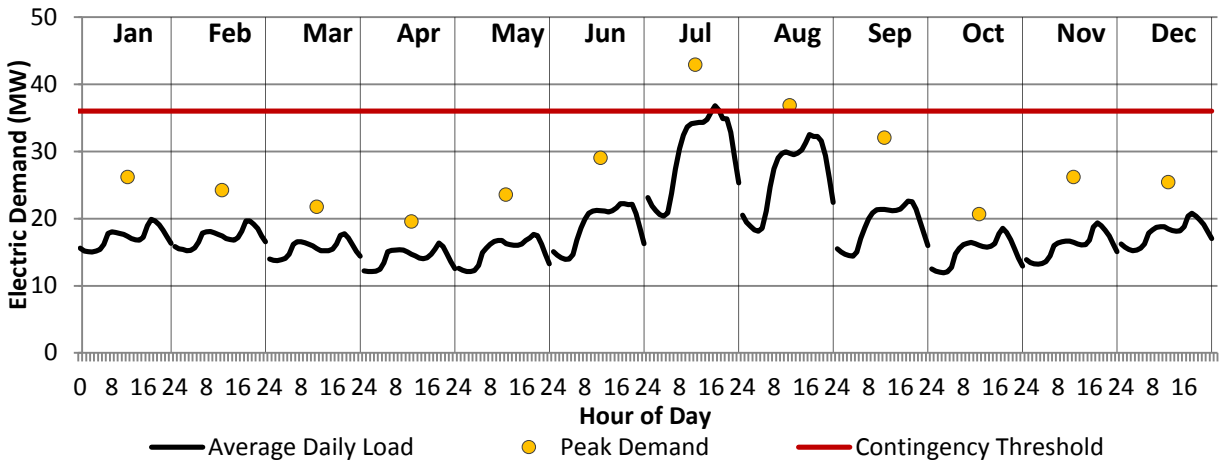


Figure 4. 2013 average daily load profile and peak demand by month

In addition to the dramatic increase in load between months, the summer months show a dramatic increase in the fluctuation in the daily average minimum and maximum demand. The difference between the average minimum and average maximum demand for March is about 4 MW, but about 16.5 MW for July.

As described above, the projected load profile for 2028 was generated using National Grid's annual load growth rates for the next 15 years. Figure 5 shows the projected average daily load profile and peak demand by month for 2028. This forecast shows that the peak demand (yellow dots in the figure) is predicted to exceed the contingency threshold in January, June, July, August, September, November, and December.

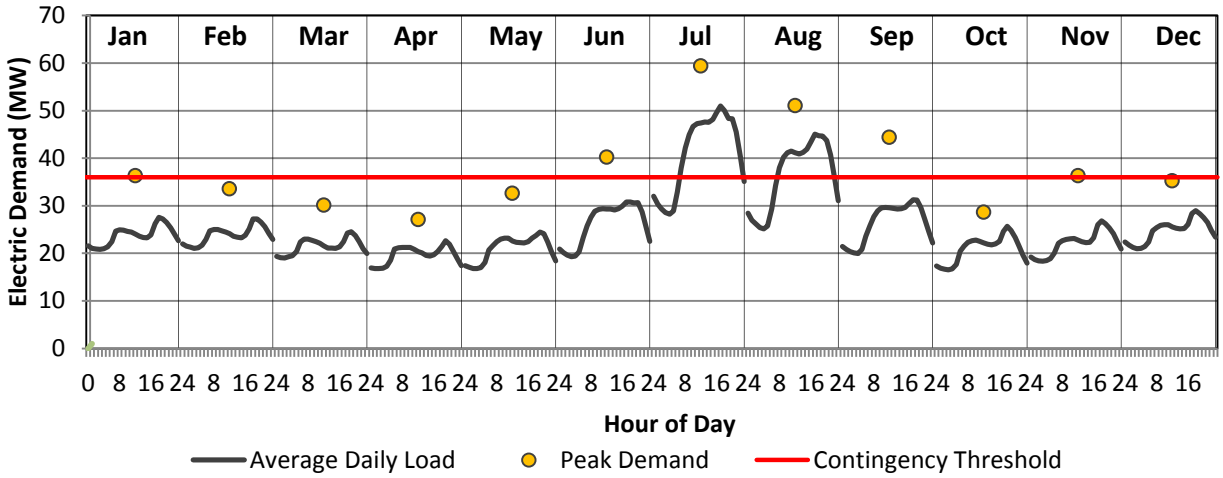


Figure 5. 2028 Average daily load profile and peak demand by month

Impact of PV on Island's Peak Demand

For this analysis, we selected a 10-MW_{DC} PV system to demonstrate the impact of large-scale PV on the Island's load profile and peak demand. It is possible that the Nantucket electrical system could accommodate more PV, but we selected 10 MW as a reasonable system size to illustrate the contribution of PV on peak demand reduction. (System impact studies would be needed to determine if, in fact, the power system could accept 10 MW of PV, or what system upgrades might be necessary to ensure that power reliability and quality are not adversely impacted.) Figure 6 shows the impact of 10 MW of PV on the forecasted 2028 average daily load and peak demand. The area between the solid lines and dotted lines is the average daily electricity (MWh) provided by PV. The 10 MW of PV provides a noticeable portion of the Island's total electricity. Over the course of a year, 10 MW of PV generates about 12,500 MWh, which is nearly 8% of the Island's projected electricity use in 2028. However, the peak electricity demand is virtually unaffected by the PV system. There is a slight reduction in peak demand in May, June, July, and September; but even these reductions are insignificant relative to the magnitude of the demand reductions necessary to avoid additional contingency capacity. PV has little impact on the peak demand because the peak PV output occurs between the hours of 6 am and 4 pm, whereas the peak electricity demand in the summer months occurs between 4 pm and 8 pm. Additionally, even if the PV output and peak demand were coincident, the PV system output depends on weather, which is inherently volatile due to the impacts of passing clouds. As a result, PV systems alone cannot be relied on to reduce peak demand on a regular basis. However, PV combined with battery storage can provide power that can be dispatched as needed to reduce peak demand.

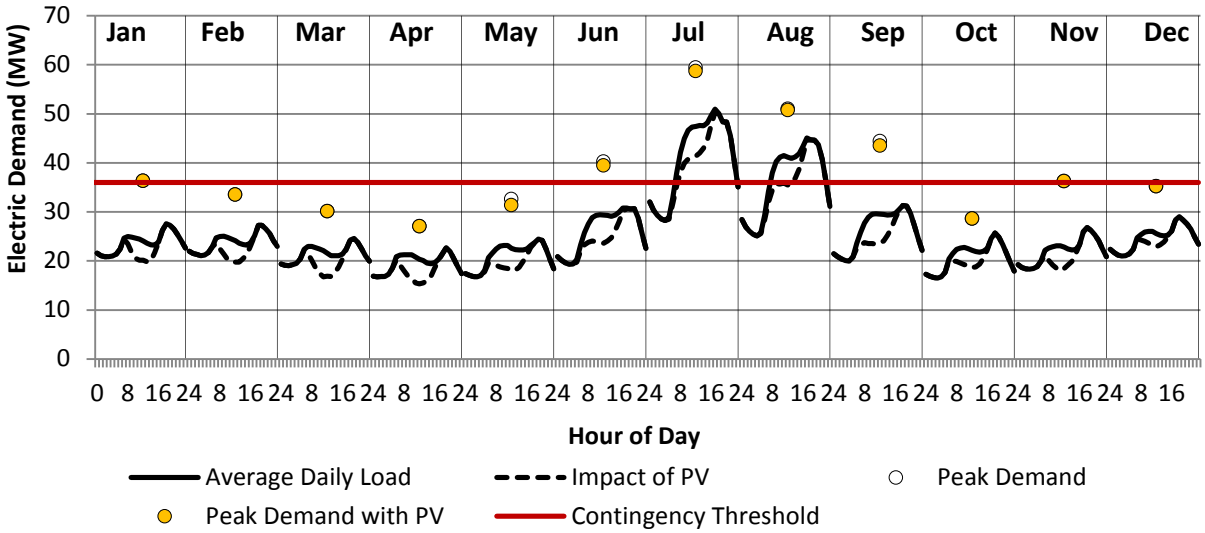


Figure 6. Impact of 10 MW PV on the Island's projected load profile and peak demand in Year 2028

Impact of PV and Battery Energy Storage on Island's Peak Demand

Battery energy storage technology and application for utility-scale demand reduction and bulk energy storage is an area of active research and development. Hawaii and California are pioneering the integration of battery energy storage at the utility transmission and distribution level. A recently announced project[5] in Kauai, HI, combines a 52 MWh battery with a 13-MW PV array to allow the power to be dispatched to coincide with the utility's peak demand during the evening hours from 5 pm to 10 pm. The Kauai Island Utility Cooperative will purchase the power through a 20-year contract for 14.5 cents/kWh. It is expected that technology and economic performance for utility-scale projects such as this will become better understood in the near future with potential application to the Nantucket peak demand issue.

Overview of Battery Technology

A number of different types of battery chemistries are appropriate for utility bulk-energy applications, such as: 1) advanced flow batteries, 2) lead-acid batteries, 3) lithium-ion (Li-ion) batteries, and 4) sodium sulfur (NaS) batteries. The performance of the different battery technologies are generally measured by power capacity (kW), energy density (kWh/kg), lifetime cycles, efficiency, and safety. The performance varies greatly between technologies and affects longevity of the batteries, safety, and cost. For example, the properties of flow batteries are suited for bulk storage because they are safe, easy to scale up, and have a long cycle life. However, they are very large and thus have a very low energy density, as well as high maintenance costs associated with mechanical pumps. Lead-acid batteries are well established

[5] Gavin Bade, "Hawaii co-op, SolarCity ink deal for dispatchable power from solar-storage project," *UtilityDive*, September 10, 2015, http://www.utilitydive.com/news/hawaii-co-op-solarcity-ink-deal-for-dispatchable-power-from-solar-storage/405408/

and are a reliable, well-characterized technology able to withstand deep discharges at a relatively low cost. Lead-acid batteries have the disadvantage of having a low energy density and low number of cycle lives. Li-ion batteries are used where light weight and high energy density are of prime importance. They can withstand deep discharges and have long cycle lives.

By looking at trends on which battery technologies are being deployed, we can often determine the technology that is favored for the stationary energy-storage market. However, data for 2007–2013 from Navigant Research Energy Storage Tracker of installed battery projects show no clear winners.[6] The market appears to be shifting since the 2015 announcement by Tesla's CEO, Elon Musk, that Tesla will be using the high-energy Li-ion battery for its new utility backup battery at reduced cost.[7]

For this analysis, we selected a 50-MWh Li-ion battery system to demonstrate the combined impact of large-scale PV and battery energy storage on the Island's load profile and peak demand. The battery size was selected based simply on the scale of the forecasted peak demand issue. Figure 7 shows the impact of 10 MW of PV and 50 MWh of battery energy storage on the forecasted 2028 average daily load and peak demand. A simple charging/discharging strategy was used in the model whereby the battery was charged during hours where demand was lowest and discharged during hours of highest demand, taking into consideration the impacts on demand from the 10-MW PV array. For this analysis, we modeled the battery to charge from 11 pm to 10 am at a rate sufficient to achieve full charge and to discharge at a constant rate from 3 pm to 10 pm.

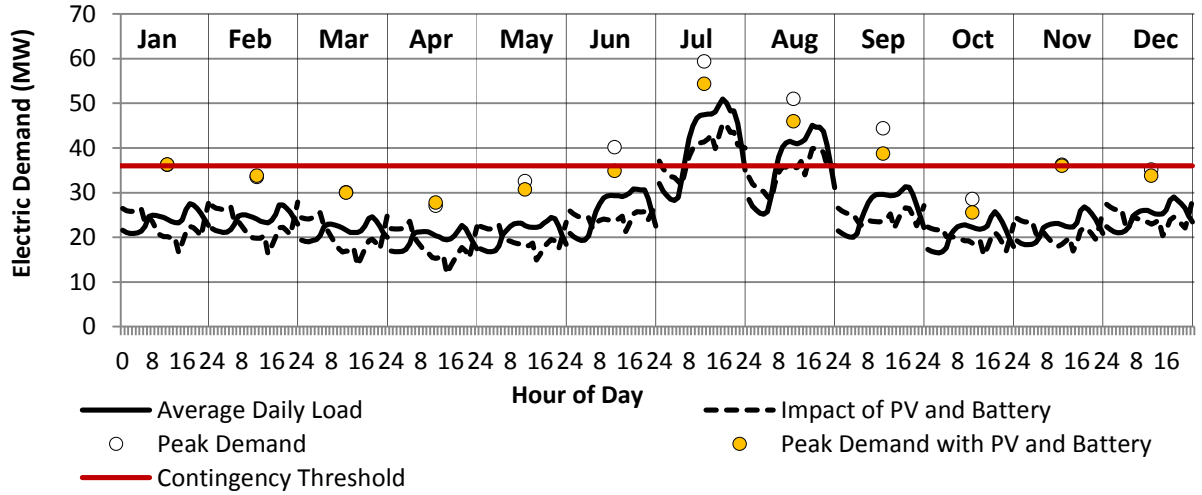


Figure 7. Impact of 10 MW PV and 50 MWh battery on the Island's projected load profile and peak demand in Year 2028

The dotted lines show the average daily load for the PV and battery scenario, and the solid lines show the projected 2028 business-as-usual average daily load. The addition of a 50-MWh battery significantly improved the peak demand reduction compared to the PV-only scenario,

[6] Navigant Research Report, Energy Storage for the Grid and Ancillary Services, 2014
[7] http://fortune.com/2015/05/18/tesla-grid-batteries-chemistry/

with demand reduction of more than 5 MW for June, July, August, and September. With more sophisticated charge/discharge controls, it may be possible to reduce the peak demand further with a battery of this size. But these results provide a basic understanding of the demand reduction potential from large-scale PV and battery energy storage.

Conclusion – Next Steps

The growing demand for electricity on Nantucket is nearing the capacity of a single supply cable and is expected to exceed the contingency threshold in the coming years. Large-scale deployment of PV alone will not have a significant impact on Nantucket's peak electrical demand. However, PV combined with battery energy storage can contribute to a reduction in the peak demand. Additionally, a smaller-scale PV project could provide the Town of Nantucket with between $1 million and $2 million net present value of avoided utility costs.

The Town of Nantucket may want to consider a PV project through a PPA with an independent power producer due to the projected favorable economics. The most economically viable project would combine net metering with SREC II incentives. A possible configuration would include multiple project sites on Town property that are less than 650 kW, or where on-site electricity demand is equal to or greater than 67% of the PV array output. Otherwise, if targeting a remote, "Greenfield" site, a Community Shared Solar project may offer the Town the benefit of developing a larger site, eligible for SREC II incentives, for which it would subscribe to half of the system's output, with the other half for sale to local residents and businesses via net-metering credits, typically at discounted electric rates. This model may also serve as an attractive solution to the many island residents who wish for solar power, but cannot develop their own systems due to strict Historic District Commission (HDC) guidelines or limited available land or roof area.

Although large-scale PV and battery energy storage show technical promise for reducing peak demand, this analysis did not evaluate the business case. Another possible next-step that Nantucket might consider is for a more-detailed techno-economic analysis to be performed to determine the optimal amount of energy storage considering multiple value streams from peak reduction, demand response and power-quality services. The Town may also wish to pursue energy storage grants or demonstration pilot project opportunities, such as the *Energy Storage Initiative* (ESI) currently being investigated by the Massachusetts Department of Energy Resources (DOER) and the Massachusetts Clean Energy Center (MassCEC).

Town of Nantucket Solar PV Project Opportunity

September 2015

The Town of Nantucket (the Town) is evaluating a unique opportunity to develop a commercial-scale solar electric (PV) generation project at a site owned by the Town's municipal airport. The solar PV project had initially been evaluated as part of an externally-funded program for the Airport to pursue carbon neutrality, which was terminated by the Airport in August 2015. The solar PV project is now being assessed by the Town and the Airport as a stand-alone project. This document presents summary information on the project opportunity that was developed in the course of the carbon neutral airport program as a basis for consideration by a private developer.

Project site. A 10- to 25-acre upland parcel is available as the project site (the Site), near the intersection of Bunker Road and Madequecham Road, which is located on the south side of the island of Nantucket, approximately three miles southeast of the historic core district and in close proximity to the Airport. The Site, which is vegetated with scrub oak and pitch pine, is not known to have hosted previous development.

Site ownership. The Site is owned by the Nantucket Memorial Airport (the Airport), which is a public entity managed under the oversight of the Airport Commission. Development rights would be conferred through competitive procurement of a private developer that would lease the Site from the Airport and sell net metering credits to the Town and Airport (see below).

Long-term purchase of net metering credits. The Town is in a uniquely advantageous position to offer a project developer the opportunity to sell net metering credits on Nantucket without the need for qualification for the program on a competitive basis. Electricity is delivered and distributed on Nantucket by the Nantucket Electric Company (Nantucket Electric), a subsidiary company of National Grid, with distinct net metering capacity limits, separate from National Grid's Massachusetts Electric Company. Nantucket Electric's historical peak load of 45.47 MW occurred on July 19, 2013, making the private customer limit equal to 1.819 MW and the public customer limit equal to 2.274 MW. At present, the full amount of each is available because, no other projects are taking advantage, or planning to take advantage, of Nantucket's allotment for net metering. Thus, all net metering credits from a 2.7-MW project could be purchased by the Town and/or the Airport for use at municipal facilities. Note that retail electric rates on Nantucket, currently in the range of 17.7 cents per kWh, are among the most expensive in the U.S.

Interconnection. The Site was the subject of a System Impact Study performed by National Grid regarding interconnection of a 1.596-MW (AC) inverter-based solar PV project to the local 13.2 kV distribution system. That study, completed in March 2015, determined that interconnection

was feasible and provided a total estimated planning-grade cost of the work associated with the interconnection to be $254,665 ± 25%, excluding certain additional costs of required pole work in Verizon maintenance areas.

Federal Aviation Administration (FAA) Permits. The FAA approved a study of potential impacts on aircraft and the control tower of glare from development of a solar PV facility at the site in September 2014. The Airport Master Plan identifies the Site as being available for development as a solar PV facility.

State Permits. The Site would need to be the subject of an initial review of potential impacts pursuant to the Massachusetts Environmental Policy Act (MEPA). A screening level review performed for the Airport indicated that a solar PV facility could be developed with no significant impacts other than mitigation of species habitat. The Town could facilitate the mitigation, the cost of which has been estimated to be on the order of $400,000 for the originally scoped facility.

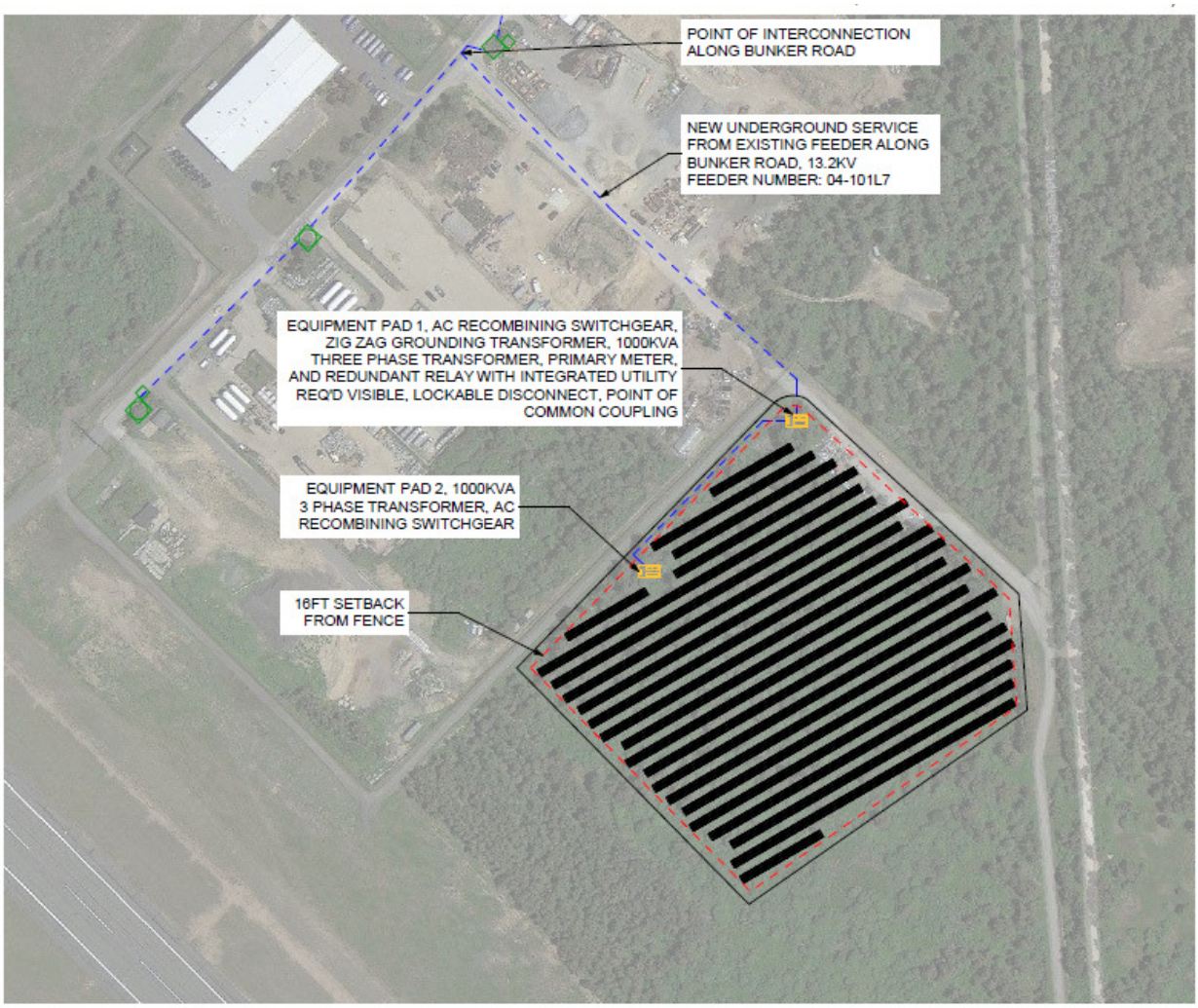
Local permits. The Site is located in an industrial zone with limited visibility from local public ways. Although the project would need to be reviewed by the Town's Historic District Commission (HDC), the Site, if developed carefully, appears to be capable of meeting the requirements for approval. The Site is dry and outside the coastal zone. Review by the Conservation Commission of the Town would not be required.

Solar Renewable Energy Certificates (SRECs). The Site would require development of a ground-mounted facility. The Site does not qualify as an eligible landfill or brownfields site; thus, to qualify for the SRECII program, the project would either need to be developed as a Community Shared Solar Generation project; have a capacity of less than 650 kW; or qualify as part of the Mass DOER's Managed Growth program. The Town cannot provide assurance regarding qualification for the SRECII program.

Procurement. The Town would proceed with procurement of a developer for this opportunity if there is sufficient developer interest in a project that could provide appreciable benefits to the Town and the Airport to justify investment or resources in the procurement process. Long-term contracts with the Town related to the project would need to be approved by the Airport Commission, the Board of Selectmen, and at an annual or special Town Meeting.

More information. Developers interested in pursuing the opportunity can contact the Town's Energy Coordinator, Lauren Sinatra, at 508-325-5379 or by email at lsinatra@nantucket-ma.gov.

Appendix A IC Site and One-line Diagrams



(1) 1,998 KW DC (1,596 KW AC) PV ARRAY WITH 6,446/310W MODULES AT FIXED 25 DEGREE TILT, 150 DEGREE AZIMUTH

Figure 2: MA-18265970 Site Diagram

SunEdison

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SunEdison Launches First Community Solar Program In Massachusetts, Announces Construction Of 2.7 Megawatt Project

BELMONT, Calif., Sept. 15, 2015 /PRNewswire/ -- SunEdison, Inc. (NYSE: SUNE), the largest global renewable energy development company, today announced that it will begin construction on the company's first community solar project in Massachusetts, a 2.7 megawatt (MW) DC solar farm in the town of Foxborough.

Community solar is a great way for homeowners and businesses to save on their utility bill without needing to install a solar system on their property. The system is typically installed at a community location and customers subscribe to receive a portion of the system's output via net metering credits.

Homeowners in the National Grid's Southeastern Massachusetts (SEMA) area can sign up for SunEdison's community solar project and receive up to a 10 percent discount on their electricity utility rate. SunEdison expects to bring more community solar programs online in Massachusetts in 2016.

"SunEdison's community solar project is an exciting opportunity for homeowners, businesses and municipalities to save money while contributing to a cleaner environment in Foxborough," said Steve Raeder, general manager of SunEdison's east coast commercial and industrial solar business. "Massachusetts has some of the most expensive electricity rates in the country, but with community solar, we're able to reduce participants' electricity costs without an up-front cash commitment and without the need to install a solar system on their property."

The town of Foxborough, Massachusetts is hosting the solar farm and has signed a 20-year power purchase agreement with SunEdison to subscribe to half of the solar farm's output. Foxborough expects to use the clean electricity to supply its municipal operations, including its schools.

"Community solar is a game changer," said William Keegan, Foxborough's town manager. "By going solar we're saving taxpayers money and bringing economic activity and cleaner air to the community. We are pleased to be able to partner with SunEdison as they enter the Massachusetts community solar market."

The solar power plant is expected to generate enough energy to power more than 320 homes. This system avoids the emission of more than five million pounds of carbon dioxide, the equivalent of taking close to 500 cars off the road per year.

Operation and maintenance of the solar farm will be performed by SunEdison Services, which provides global asset management, monitoring and reporting services.

About SunEdison

SunEdison is the largest global renewable energy development company and is transforming the way energy is generated, distributed, and owned around the world. The company develops, finances, installs, owns and operates renewable power plants, delivering predictably priced electricity to its residential, commercial, government and utility customers. SunEdison is one of the world's largest renewable energy asset managers and provides customers with asset management, operations and maintenance, monitoring and reporting services. Corporate headquarters are in the United States with additional offices and technology manufacturing around the world. SunEdison's common stock is listed on the New York Stock Exchange under the symbol "SUNE." To learn more visit www.sunedison.com.

Forward Looking Statements

This communication contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Exchange Act. Forward-looking statements can be identified by the fact that they do not relate strictly to historical or current facts. These statements involve estimates, expectations, projections, goals, assumptions, known and unknown risks, and uncertainties and typically include words or variations of words such as "expect," "anticipate," "believe," "intend," "plan," "seek," "estimate," "predict," "project," "goal," "guidance," "outlook," "objective," "forecast," "target," "potential," "continue," "would," "will," "should," "could," or "may" or other comparable terms and phrases. All statements that address operating performance, events, or developments that SunEdison expects or anticipates will occur in the future are forward-looking statements. They may include estimates of expected cash available for distribution (CAFD), earnings, revenues, capital expenditures, liquidity, capital structure, future growth, and other financial performance items (including future dividends per share), descriptions of management's plans or objectives for future operations, products, or services, or descriptions of assumptions underlying any of the above. Forward-looking statements provide SunEdison's current expectations or predictions of future conditions, events, or results and speak only as of the date they are made. Although SunEdison believes its expectations and assumptions are reasonable, it can give no assurance that these expectations and assumptions will prove to have been correct and actual results may vary materially.

By their nature, forward-looking statements are subject to risks and uncertainties that could cause actual results to differ materially from those suggested by the forward-looking statements. Factors that might cause such differences include, but are not limited to, a variety of economic, competitive, and regulatory factors, many of which are beyond SunEdison's control and are described in SunEdison's Form 10-K for the fiscal year ended December 31, 2014, as well as additional factors it may describe from time to time in other filings with the Securities and Exchange Commission. You should understand that it is not possible to predict or identify all such factors and,

Town of Foxboro Fact Sheet

Location: Elm Street Foxoboro, MA

System Details

System Size: 2,667 kW (DC)

Production:

	Estimated Production (kWh)		Estimate Production (kWh)
Year 1	3,370,178	**Year 11**	3,205,410
Year 2	3,353,327	**Year 12**	3,189,383
Year 3	3,336,560	**Year 13**	3,173,436
Year 4	3,319,878	**Year 14**	3,157,569
Year 5	3,303,278	**Year 15**	3,141,781
Year 6	3,286,762	**Year 16**	3,126,073
Year 7	3,270,328	**Year 17**	3,110,442
Year 8	3,253,976	**Year 18**	3,094,890
Year 9	3,237,707	**Year 19**	3,079,416
Year 10	3,221,518	**Year 20**	3,064,018

Contact Details

Procured though PowerOptions Solar Program

Contract Type: Power Purchase Agreement (PPA) with site license

Offtake Agreement: Half of the offtake is purchased by the town and the other half of the offtake is purchased by local residents.

Program Highlights

Simple Implementation

SunEdison has tailored a solar program which simplifies the PPA contractual process. Upon contract execution, SunEdison will handle all the details – from system design and installation to ongoing operations and maintenance – leaving you free to focus on your core business.

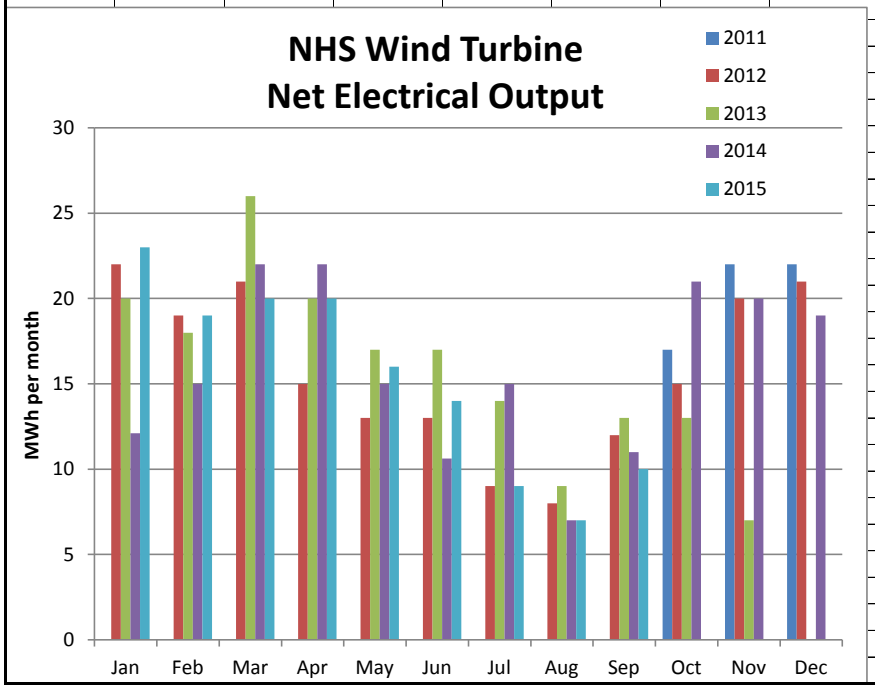
Revenue for the Town

SunEdison will design, install and maintain a solar energy at absolutely no upfront cost to the town. In fact, the town will receive revenue in the form of site lease payments.

Nantucket High School
Wind Turbine Output

REC Production

	2011	2012	2013	2014	2015
Jan		22	20	12	23
Feb		19	18	15	19
Mar		21	26	22	20
Apr		15	20	22	20
May		13	17	15	16
Jun		13	17	11	14
Jul		9	14	15	9
Aug		8	9	7	7
Sep		12	13	11	10
Oct	17	15	13	21	
Nov	22	20	7	20	
Dec	22	21	0	19	
Total	61	188	174	190	138
	751	Since start-up			

Value of REC Sales

Period of generation	Total for Quarter	Buyer	Price	Amount	Invoice date	Invoice amount	Cumulative
4Q 2011	61	Nat Grid	$ 56.00	$ 3,416.00	1-Jun-12		
1Q 2012	62	Nat Grid	$ 52.00	$ 3,224.00	1-Jun-12	$ 6,640.00	
2Q 2012	41	Nat Grid	$ 52.00	$ 2,132.00	15-Oct-12	$ 2,132.00	$ 17,000.00
3Q 2012	29	Nat Grid	$ 52.00	$ 1,508.00	15-Jan-13	$ 1,508.00	$ 18,508.00
4Q 2012	56	Nat Grid	$ 52.00	$ 2,912.00	18-Apr-13	$ 2,912.00	$ 21,420.00
1Q 2013	64	Nat Grid	$ 59.50	$ 3,808.00	15-Jul-13	$ 3,808.00	$ 25,228.00
2Q 2013	54	Nat Grid	$ 59.50	$ 3,213.00	15-Oct-13	$ 3,213.00	$ 28,441.00
3Q 2013	36	Nat Grid	$ 59.50	$ 2,142.00	17-Jan-14	$ 2,142.00	$ 30,583.00
4Q 2013	20	Nat Grid	$ 59.50	$ 1,190.00	17-Apr-14	$ 1,190.00	$ 31,773.00
1Q 2014	50	NStar	$ 61.00	$ 3,050.00	15-Jul-14	$ 3,050.00	$ 34,823.00
2Q 2014	48	NStar	$ 61.00	$ 2,928.00	15-Oct-14	$ 2,928.00	$ 37,751.00
3Q 2014	34	NStar	$ 61.00	$ 2,074.00	18-Jan-15	$ 2,074.00	$ 39,825.00
4Q 2014	60	NStar	$ 61.00	$ 3,660.00	15-Apr-15	$ 3,660.00	$ 43,485.00
1Q 2015	61	NStar	$ 56.75	$ 3,461.75	15-Jul-15	$ 3,461.75	$ 46,946.75
2Q 2015	50	NStar	$ 56.75	$ 2,837.50	15-Oct-15	$ 2,837.50	$ 49,784.25